ABSTRACT

Airshed modeling undertaken for evaluation of various emission control strategies has typically utilized only a few air pollution episodes, which may or may not represent either the typical meteorological conditions associated with high ozone episodes, or the possible impact of day-of-the-week variation in precursor emissions or meteorological conditions. The present research effort focused on California's South Coast Air Basin (SoCAB) "smog season" of 1 May to 31 October for the years 1986-96, and had the following primary objectives: to expand the meteorological and ambient air quality databases developed in the previously reported-on first phase of this project; to further examine the degree of correlation between ozone and NO_2 and NO_x ambient air concentrations and implications for day-of-the-week variation in carry-over; and to perform the first-ever investigation, for the SoCAB, of possible day-of-the-week variation in meteorological conditions due to anthropogenic influences. In addition, a number of related exploratory studies were conducted, including analysis of the monthly and day-of-the-week distributions of high and middle ozone days, use of gridded meteorological data to objectively determine large-scale meteorological conditions associated with high ozone episodes, and examination of the potential utility of available data for industrial emissions and traffic activity patterns.

Results suggest that precursor carryover from Friday evening to Saturday may be of greater significance than that occurring during the middle-of-the-week but that carryover effects for NO_2 and NO_x are modest at best throughout the week. Examination of 1986-96 data yielded general confirmation of the findings in the Phase I study that morning NO_2 correlates best with the ozone maximum in the same subregion, and that Coastal/Metropolitan NO_2 no longer correlates well with the afternoon Basin ozone maximum.

Analysis of the day-of-the-week variations in ambient concentrations of NMHC, NO_x, and peak ozone for the recent 1994-95 period suggests that reductions in ozone precursor concentrations from Friday to Saturday and from Saturday to Sunday coincide with increases in weekend Basin peak ozone levels relative to Friday. However, examination of trends over the eleven-year period 1986-96 indicates that ozone levels in the SoCAB have decreased substantially, coinciding with decreases in both NO_x and NMHC ambient concentrations. Thus the transitory "weekend effect" we and others have identified does not provide evidence that further NO_x reductions for all days of the week will produce a corresponding increase in ambient ozone concentrations.

A general decrease in morning NO_2, NO_x, and NMHC ambient concentrations was found to have occurred over the eleven-year study period, along with a general decrease in hours and days of ozone exceedance at all concentration levels, and more notably in the number of hours of high concentrations. A more dramatic decrease in Basinwide

concentrations of both NO_x and NMHC (~20-25%) occurred between summer (July through September) 1995 and summer 1996. This appears to be a consequence of the introduction of RFG Phase II gasoline. Although a commensurate substantial reduction was seen in certain ozone metrics for mid-Basin stations, the overall magnitude of corresponding reduction in ozone concentrations was perhaps less dramatic, except for the decrease in first stage ozone alerts from 7 to 1.

Investigation of anthropogenic influences on day-of-the-week variations in SoCAB meteorological conditions yielded only one weak positive result: a general tendency for weekday surface air temperatures to be slightly warmer than corresponding weekend temperatures. The very small magnitude of the difference suggests this finding is unlikely to be of consequence to air quality management efforts. A gradual increase between 1949 and 1994 in the mean smog season daily-maximum temperature of about 2 °F was observed, however, for both weekdays and weekend days at the Los Angeles Civic Center.

Exploratory analyses of the respective distributions through the smog season of groups of days with high and average SoCAB peak hourly-average ozone concentrations indicates that highest ozone days tended to occur mostly during the middle of the smog season while middle ozone days were more broadly distributed. Highest ozone days also tended to occur more often late rather than early in the week (i.e., Friday, Saturday rather than Sunday, Monday).

Exploratory analyses using gridded meteorological data to objectively determine the large-scale meteorological conditions associated with high ozone episodes showed these events tended to be associated with a strong 500 mb west coast ridge and offshore trough, with these features shifting slightly eastward during the 36-hour period leading up to the occurrence of the composite high ozone event. High correlations were found between SoCAB maximum ozone concentration and objectively-analyzed same-day 1700 PDT 850 mb temperatures.

Implications of these results for NO_x and VOC control strategies will remain unclear until more accurate emissions data (especially for speciated VOC) become available for the SoCAB by day-of-the-week and by subregion, and until a more robust quantitative relationship is developed between key ozone metrics and ambient meteorological conditions. Improved understanding of the detailed three-dimensional airflow through the SoCAB, and its diurnal variation during specific air pollution episodes, would also be extremely helpful in this regard.

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